AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

<u>Listing of Claims:</u>

1. (Currently Amended) An electric field sensor comprising:

a light source (1);

an electro optic crystal [[(7)]] which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of light incident from said light source [[(1)]] according to the birefringent index and emits the light;

a detector [[(9, 17, 19, 21)]] that detects an electric signal according to the change of the polarization state of the light emitted from said electro optic crystal [[(7)]];

a first electrode [[(11)]] that is provided close to said electro optic crystal [[(7)]], and that applies the electric field based on the signal under test to said electro optic crystal [[(7)]];

a second electrode [[(12)]] that is provided close to said electro optic crystal [[(7)]], thereby forming a pair with said first electrode [[(11)]]; and

an auxiliary electrode [[(61)]] that is electrically connected to said second electrode [[(12)]], and that forms a capacitance with ground.

2. (Currently Amended) The electric field sensor according to claim 1, wherein a surface area of said auxiliary electrode [[(61)]] is larger than each surface area of said first electrode [[(11)]] and said second electrode [[(12)]].

3. (Currently Amended) The electric field sensor according to claim 2, wherein a shape of said auxiliary electrode [[(61)]] is any one of a bar shape, a tabular shape, and a spherical shape.

4. (Currently Amended) The electric field sensor according to claim 1, wherein a distance between said auxiliary electrode [[(61)]] and said second electrode [[(12)]] is larger than a distance between said first electrode [[(11)]] and said second electrode [[(12)]].

5. (Currently Amended) The electric field sensor according to claim 1, further comprising distance changing means for changing a distance between said auxiliary electrode [[(61)]] and said second electrode [[(12)]] by moving said auxiliary electrode [[(61)]].

6. (Currently Amended) The electric field sensor according to claim 5, further comprising control means [[(63)]] for controlling said detector [[(9, 17, 19, 21)]] to operate when said distance changing means separates said auxiliary electrode [[(61)]] from said second electrode [[(12)]] by a predetermined distance or more.

7. (Currently Amended) The electric field sensor according to claim 1, wherein said auxiliary electrode [[(61)]] is insulated from a circuit that constitutes said detector [[(9, 17, 19, 21)]] and a circuit that drives said light source [[(1)]].

8. - 11. (Canceled)

12. (Currently Amended) An electric field sensor comprising:

an electro optic crystal [[(7)]] which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of incident light according to the birefringent index and emits the light;

a polarizing beam splitter [[(9)]] that transmits ~~one of~~ a P polarized light component ~~and an S polarized light component~~ of the light having the changed polarization state which

is emitted from said electro optic crystal [[(7)]], and that reflects ~~the other of the~~ <u>an S</u>

polarized light ~~components~~ <u>component of the light</u>, thereby splitting said light having the

changed polarization state into the P polarized light component and the S polarized light

component;

a first quarter wave plate [[(59)]] that converts the P polarized light component into a

circularly polarized light;

a second quarter wave plate [[(57)]] that converts the S polarized light component

into a circularly polarized light;

a first photo detector [[(19)]] that converts the P polarized light component, which is

converted into the circularly polarized light by said first quarter wave plate [[(59)]], into an

electric signal; and

a second photo detector [[(17)]] that converts the S polarized light component, which

is converted into the circularly polarized light by said second quarter wave plate [[(57)]], into

an electric signal<u>,</u>

<u>wherein a part of the circularly polarized light reflected from a light receiving surface</u>

<u>of said first photo detector passes through said first quarter wave plate to be converted into</u>

<u>the S polarized light, which is then reflected from said polarizing beam splitter, and a part of</u>

<u>the circularly polarized light reflected from a light receiving surface of said second photo</u>

<u>detector passes through said second quarter wave plate to be converted into the p polarized</u>

<u>light, which passes through said polarizing beam splitter so that the circularly polarized light</u>

<u>reflected from the light receiving surfaces of said first and second photo detectors is</u>

<u>prevented from returning toward said electro optic crystal.</u>

13. (Canceled)

14. (Currently Amended) ~~The~~ <u>An</u> electric field sensor ~~according to claim 13,~~

<u>comprising:</u>

<u>a light source;</u>

an electro optic crystal which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of light incident from said light source according to the birefringent index and emits the light;

a paid of electrodes for applying the electric field based on the signal under test to said electro optic crystal;

a detector that splits the light emitted from said electro optic crystal into a P polarized light component and an S polarized light component, and obtains an alternate current signal corresponding to a difference between intensities of the respective polarized light components; and

compensating means for offsetting a change in a polarization state of the light incident from said light source when the electric field is not applied, due to a natural birefringence held by said electro optic crystal,

wherein the light incident to said electro optic crystal [[(7)]] is an optional polarized light, and

said compensating means comprises:

a quarter wave plate [[(6)]] of which an electric main axis coincides with a main axis of an elliptically polarized light emitted from said electro optic crystal [[(7)]], and which converts the elliptically polarized light into a linearly polarized light; and

a half wave plate [[(8)]] that adjusts an angle of a polarization surface of the linearly polarized light emitted from said quarter wave plate [[(6)]] based on a fact that an angle formed between an electric main axis of said half wave plate [[(8)]] and the electric main axis of said electro optic crystal [[(7)]] is [[n·45°-ϕo/2]] $n \cdot \pi/4 - \phi_o/2$ (where n is an integer) when an angle formed between the polarization surface of the linearly polarized light from said quarter wave plate [[(6)]] and the electric main axis of said electro optic crystal [[(7)]] is [[45°-ϕo]] $\pi/4 - \phi_o$ without the electric field applied.

15. (Currently Amended) ~~The~~ An electric field sensor ~~according to claim 13,~~ comprising:

a light source;

an electro optic crystal which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of light incident from said light source according to the birefringent index and emits the light;

a pair of electrodes for applying the electric field based on the signal under test to said electro optic crystal;

a detector that splits the light emitted from said electro optic crystal into a P polarized light component and an S polarized light component, and obtains an alternate current signal corresponding to a difference between intensities of the respective polarized light components; and

compensating means for offsetting a change in a polarization state of the light incident from said light source when the electric field if not applied, due to a natural birefringence held by said electro optic crystal,

wherein the light incident to said electro optic crystal [[(7)]] is a linearly polarized light of which a polarization surface forms an angle [[45°]] $\pi/4$ with an electric main axis of said electro optic crystal [[(7)]], and

said compensating means comprises:

a quarter wave plate [[(6)]] of which an electric main axis forms an angle [[45°]] $\pi/4$ with the electric main axis of said electro optic crystal [[(7)]], and which converts an elliptically polarized light emitted from said electro optic crystal [[(7)]] into a linearly polarized light; and

a half wave plate [[(8)]] that adjusts an angle of a polarization surface of the linearly polarized light emitted from said quarter wave plate [[(6)]] based on a fact that an angle formed between an electric main axis of said half wave plate [[(8)]] and the electric

main axis of said electro optic crystal [[(7)]] is [[n·45°-φo/2]] n·π/4φ₀/2 (where n is an

integer) when a phase difference included in the elliptically polarized light emitted from said

electro optic crystal [[(7)]] is [[φo]] φ₀ without the electric field applied.

16 (Currently Amended) An The electric field sensor according to claim 13,

comprising:

a light source;

an electro optic crystal which is applied with an electric field based on a signal under

test, in which a birefringent index changes according to the electric field, and which changes

a polarization state of light incident from said light source according to the birefringent index

and emits the light;

a pair of electrodes for applying the electric field based on the signal under test to said

electro optic crystal;

a detector that splits the light emitted from said electro optic crystal into a P polarized

light component and an S polarized light component, and obtains an alternate current signal

corresponding to a difference between intensities of the respective polarized light

components; and

compensating means for offsetting a change in a polarization state of the light

incident from said light source when the electric field is not applied, due to a natural

birefringence held by said electro optic crystal,

wherein the light incident to said electro optic crystal [[(7)]] is a circularly polarized

light, and

said compensating means comprises:

a quarter wave plate [[(6)]] of which an electric main axis forms an angle

[[45°]] π/4 with an electric main axis of said electro optic crystal [[(7)]], and which converts

an elliptically polarized light emitted from said electro optic crystal [[(7)]] into a linearly

polarized light; and

a half wave plate [[(8)]] that adjusts an angle of a polarization surface of the linearly polarized light emitted from said quarter wave plate [[(6)]] based on a fact that an angle formed between an electric main axis of said half wave plate [[(8)]] and the electric main axis of said electro optic crystal [[(7)]] is [[n·45°-φo/2]] $\underline{n \cdot \pi/4 \phi_o/2}$ (where n is an integer) when a phase difference included in the elliptically polarized light emitted from said electro optic crystal [[(7)]] is [[φo]] $\underline{\phi_o}$ without the electric field applied.

17. (Currently Amended) The electric field sensor according to claim 14, wherein [[φo]] $\underline{\phi_o}$ is determined based on [[φo=(2π/λ)(no-ne)L]] $\underline{\phi_o=(2\pi/\lambda)(n_o-n_e)L}$, where

[[no]] $\underline{n_o}$ is a refractive index of said electro optic crystal for ordinary light,

[[ne]] $\underline{n_e}$ is a refractive index of said electro optic crystal for extraordinary light,

λ is a wavelength (meter) of light in vacuum, and

L is a length (meter) of said electro optic crystal in the direction of light.

18. (Currently Amended) ~~The~~ An electric field sensor ~~according to claim 13,~~ comprising:

a light source;

an electro optic crystal which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of light incident from said light source according to the birefringent index and emits the light;

a pair of electrodes for applying the electric field based on the signal under test to said electro optic crystal;

a detector that splits the light emitted from said electro optic crystal into a P polarized light component and an S polarized light component, and obtains an alternate current signal corresponding to a difference between intensities of the respective polarized light components; and

compensating means for offsetting a change in a polarization state of the light incident from said light source when the electric field is not applied, due to a natural birefringence held by said electro optic crystal,

wherein said compensating means comprises:

a pair of control electrodes [[(23, 25)]] for applying the electric field based on a control signal [[(29)]] to said electro optic crystal; and

control signal generating means [[((27, 31), (43, 44, 45, 47, 49))]] for generating the control signal [[(29)]] that offsets based on the alternate current signal obtained by said detector, a change in the polarization state of the light incident from said light source [[(1)]] when the electric field based on the signal under test is not applied, based on the alternate current signal obtained by said detector (9, 17, 19, 21).

19. (Currently Amended) ~~The~~ An electric field sensor ~~according to claim 13,~~ comprising:

a light source;

an electro optic crystal which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of light incident from said light source according to the birefringent index and emits the light;

a pair of electrodes for applying the electric field based on the signal under test to said electro optic crystal;

a detector that splits the light emitted from said electro optic crystal into a P polarized light component and an S polarized light component, and obtains an alternate current signal corresponding to a difference between intensities of the respective polarized light components; and

compensating mean for offsetting a change in a polarization state of the light incident from said light source when the electric field is not applied, due to a natural birefringence held by said electro optic crystal,

wherein said compensating means comprises:

an adder [[(33)]] that adds a control signal [[(29)]] to the signal under test; and

control signal generating means [[((27, 31), (43, 44, 45, 47, 49))]] for generating the control signal [[(29)]] that offsets, based on the alternate current signal obtained by said detector, a change in the polarization state of the light incident from said light source [[(1)]] when the electric field based on the signal under test is not applied, based on the alternate current signal obtained by said detector (9, 17, 19, 21).

20. (Currently Amended) The electric field sensor according to claim 18 or 19, wherein said control signal generating means comprises:

a first buffer amplifier and a second buffer amplifier [[(43, 44)]] that input an electric signal based on the P polarized light component and an electric signal based on the S polarized light component, respectively;

a first low-pass filter and a second low-pass filter [[(45, 47)]] that input outputs from said first buffer amplifier and said second buffer amplifier [[(43, 44)]], respectively; and

an integrator [[(49)]] that inputs outputs from said first low-pass filter and said second low-pass filter [[(45, 47)]], respectively, and that integrates a difference between the outputs.

21. (Currently Amended) A method of adjusting an electric field sensor comprising: a light source [[(1)]]; an electro optic crystal [[(7)]] which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of incident optional polarized light according to the birefringent index and emits the light; a pair of electrodes [[(11, 13)]] for applying the electric field based on the signal under test to said electro optic crystal [[(7)]]; and a detector [[(9, 17, 19, 21)]] that splits the light emitted from said electro optic crystal [[(7)]] into a P polarized light component and an S polarized light component, and obtains an alternate current signal corresponding to a difference between intensities of the respective polarized light components, the method comprising:

providing a quarter wave plate [[(6)]] that converts an elliptically polarized light emitted from said electro optic crystal [[(7)]] into a linearly polarized light such that an electric main axis of said quarter wave plate [[(6)]] coincides with an electric main axis of the elliptically polarized light; and

providing a half wave plate [[(8)]] that adjusts an angle of a polarization surface of the linearly polarized light emitted from said quarter wave plate [[(6)]] such that an angle formed between an electric main axis of said half wave plate [[(8)]] and the electric main axis of said electro optic crystal [[(7)]] becomes [[n·45°-ϕo/2]] $\underline{n \cdot \pi/4 - \phi_o/2}$ (where n is an integer) when an angle formed between the polarization surface of the linearly polarized light from said quarter wave plate [[(6)]] and the electric main axis of said electro optic crystal [[(7)]] is [[45°-ϕo]] $\underline{\pi/4 - \phi_o}$ without the electric field applied.

22. (Currently Amended) A method of adjusting an electric field sensor comprising: a light source [[(1)]]; an electro optic crystal [[(7)]] which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of a linearly polarized light whose polarization surface forms an angle [[45°]] $\underline{\pi/4}$ with an electric main axis of said electro optic crystal [[(7)]] according to the birefringent index and emits the light; a pair of electrodes [[(11, 13)]] for applying the electric field based on the signal under test to said electro optic crystal [[(7)]]; and a detector [[(9, 17, 19, 21)]] that splits the light emitted from said electro optic crystal [[(7)]] into a P polarized light component and an S polarized light component, and obtains an alternate current signal corresponding to a difference between intensities of the respective polarized light components, the method comprising:

providing a quarter wave plate [[(6)]] that converts an elliptically polarized light emitted from said electro optic crystal [[(7)]] into a linearly polarized light such that an electric main axis of said quarter wave plate [[(6)]] forms an angle [[45°]] $\underline{\pi/4}$ with an electric main axis of said electro optic crystal [[(7)]]; and

providing a half wave plate [[(8)]] that adjusts an angle of a polarization surface of the linearly polarized light emitted from said quarter wave plate [[(6)]] such that an angle formed between an electric main axis of said half wave plate [[(8)]] and the electric main axis of said electro optic crystal [[(7)]] becomes [[n·45°-φo/2]] n·π/4-φ_o/2 (where n is an integer) when a phase difference included in the elliptically polarized light emitted from said electro optic crystal [[(7)]] is [[φo]] φ_o without the electric field applied.

23. (Currently Amended) A method of adjusting an electric field sensor comprising: a light source [[(1)]]; an electro optic crystal [[(7)]] which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of incident circularly polarized light according to the birefringent index and emits the light; a pair of electrodes [[(11, 13)]] for applying the electric field based on the signal under test to said electro optic crystal [[(7)]]; and a detector [[(9, 17, 19, 21)]] that splits the light emitted from said electro optic crystal [[(7)]] into a P polarized light component and an S polarized light component, and obtains an alternate current signal corresponding to a difference between intensities of the respective polarized light components, the method comprising:

providing a quarter wave plate [[(6)]] that converts an elliptically polarized light emitted from said electro optic crystal [[(7)]] into a linearly polarized light such that an electric main axis of said quarter wave plate [[(6)]] forms an angle [[45°]] π/4 with an electric main axis of said electro optic crystal [[(7)]]; and

providing a half wave plate [[(8)]] that adjusts an angle of a polarization surface of the linearly polarized light emitted from said quarter wave plate [[(6)]] such that an angle formed between an electric main axis of said half wave plate [[(8)]] and the electric main axis of said electro optic crystal [[(7)]] becomes [[n·45°-φo/2]] n·π/4-φ_o/2 (where n is an integer) when a phase difference included in the elliptically polarized light emitted from said electro optic crystal [[(7)]] is [[φo]] φ_o without the electric field applied.

24. (Currently Amended) The method of adjusting an electric field sensor according to claim 21, wherein [[ϕo]]$\underline{\phi_o}$ is determined based on [[ϕo=$(2\pi/\lambda)$(no-ne)L]] $\underline{\phi_o=(2\pi/\lambda)\ (n_o-n_e)L}$, where

[[no]] $\underline{n_o}$ is a refractive index of said electro optic crystal for ordinary light,

[[ne]] $\underline{n_e}$ is a refractive index of said electro optic crystal for extraordinary light,

λ is a wavelength (meter) of light in vacuum, and

L is a length (meter) of said electro optic crystal in the direction of light.

25. (Currently Amended) The method of adjusting an electric field sensor according to claim 21, wherein [[ϕo]] $\underline{\phi_o}$ is determined by measurement.

26. (Currently Amended) A method of adjusting an electric field sensor comprising: a light source [[(1)]]; an electro optic crystal [[(7)]] which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of light incident from said light source [[(1)]] according to the birefringent index and emits the light; a pair of electrodes [[(11, 13)]] for applying the electric field based on the signal under test to said electro optic crystal [[(7)]]; a detector [[(9, 17, 19, 21)]] that splits the light emitted from said electro optic crystal [[(7)]] into a P polarized light component and an S polarized light component, and obtains an alternate current signal corresponding to a difference between intensities of the respective polarized light components; a pair of control electrodes [[(23, 25)]] for applying an electric field based on a control signal [[(29)]] to said electro optic crystal [[(7)]]; and control signal generating means [[(31)]] for generating the control signal [[(29)]], the method comprising:

displaying the alternate current signal obtained by said detector [[(9, 17, 19, 21)]]; and

adjusting said control signal generating means [[(31)]] to generate the control signal [[(29)]] that offsets, based on the displayed alternate current signal, a change in the

polarization state of the light incident from said light source [[(1)]] when the electric field based on the signal under test is not applied, based on the displayed alternate current signal.

27. (Currently Amended) A method of adjusting an electric field sensor comprising: a light source [[(1)]]; an electro optic crystal [[(7)]] which is applied with an electric field based on a signal under test, in which a birefringent index changes according to the electric field, and which changes a polarization state of light incident from said light source [[(1)]] according to the birefringent index and emits the light; a pair of electrodes [[(11, 13)]] for applying the electric field based on the signal under test to said electro optic crystal [[(7)]]; a detector [[(9, 17, 19, 21)] that splits the light emitted from said electro optic crystal [[(7)]] into a P polarized light component and an S polarized light component, and obtains an alternate current signal corresponding to a difference between intensities of the respective polarized light components; an adder [[(33)]] that adds a control signal [[(29)]] to the signal under test; and control signal generating means [[(31)]] for generating said control signal [[(29)]], the method comprising:

displaying the alternate current signal obtained by said detector [[(9, 17, 19, 21)]]; and

adjusting said control signal generating means [[(31)]] to generate the control signal [[(29)]] that offsets, based on the displayed alternate current signal, a change in the polarization state of the light incident from said light source [[(1)]] when the electric field based on the signal under test is not applied, based on the displayed alternate current signal.

28. (Currently Amended) The electric field sensor according to claim 15, wherein [[ϕo]] ϕ_o is determined based on [[ϕo=(2π/λ)(no-ne)L]] ϕ_o=(2π/λ) (n$_o$-n$_e$)L, where

[[no]] n$_o$ is a refractive index of said electro optic crystal for ordinary light,

[[ne]] n$_e$ is a refractive index of said electro optic crystal for extraordinary light,

λ is a wavelength (meter) of light in vacuum, and

L is a length (meter) of said electro optic crystal in the direction of light.

29. (Currently Amended) The electric field sensor according to claim 16, wherein [[ϕo]] $\underline{\phi_o}$ is determined based on [[ϕo=(2π/λ)(no-ne)L]] $\underline{\phi_o=(2\pi/\lambda)(n_o-n_e)L}$, where

    [[no]] $\underline{n_o}$ is a refractive index of said electro optic crystal for ordinary light,

    [[ne]] $\underline{n_e}$ is a refractive index of said electro optic crystal for extraordinary light,

    λ is a wavelength (meter) of light in vacuum, and

    L is a length (meter) of said electro optic crystal in the direction of light.

30. (Currently Amended) The electric field sensor according to claim 19, wherein said control signal generating means comprises:

    a first buffer amplifier and a second buffer amplifier [[(43, 44)]] that input an electric signal based on the P polarized light component and an electric signal based on the S polarized light component, respectively;

    a first low-pass filter and a second low-pass filter [[(45, 47)]] that input outputs from said first buffer amplifier and said second buffer amplifier [[(43, 44)]], respectively; and

    an integrator [[(49)]] that inputs outputs from said first low-pass filter and said second low-pass filter [[(45, 47)]], respectively, and that integrates a difference between the outputs.

31. (Currently Amended) The method of adjusting an electric field sensor according to claim 22, wherein [[ϕo]] $\underline{\phi_o}$ is determined based on [[ϕo=(2π/λ)(no-ne)L]] $\underline{\phi_o=(2\pi/\lambda)(n_o-n_e)L}$, where

    [[no]] $\underline{n_o}$ is a refractive index of said electro optic crystal for ordinary light,

    [[ne]] $\underline{n_e}$ is a refractive index of said electro optic crystal for extraordinary light,

    λ is a wavelength (meter) of light in vacuum, and

    L is a length (meter) of said electro optic crystal in the direction of light.

32. (Currently Amended) The method of adjusting an electric field sensor according to claim 23, wherein [[φo]] $\underline{\phi_o}$ is determined based on [[φo=(2π/λ)(no-ne)L]] $\underline{\phi_o=(2\pi/\lambda)(n_o-n_e)L}$, where

[[no]] $\underline{n_o}$ is a refractive index of said electro optic crystal for ordinary light,

[[ne]] $\underline{n_e}$ is a refractive index of said electro optic crystal for extraordinary light,

λ is a wavelength (meter) of light in vacuum, and

L is a length (meter) of said electro optic crystal in the direction of light.

33. (Currently Amended) The method of adjusting an electric field sensor according to claim 22, wherein [[φo]] $\underline{\phi_o}$ is determined by measurement.

34. (Currently Amended) The method of adjusting an electric field sensor according to claim 23, wherein [[φo]] $\underline{\phi_o}$ is determined by measurement.